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Arbor Day—Every Day

Man and tree have shared a long and quiet adventure. In his dawntime man lived in groves and woods as a gatherer of fruit and a worshipper of arboreal deities. Throughout the millenia of man's nomadic era it was the earth-rooted tree that became his oldest and best ally, a source of shelter, food, fuel, and weapons. Still later, as man settled to take up husbandry, the tree came to stand for beauty and home.

With the colonization of the New World, the vast eastern forests were viewed as something to conquer, not nurture. Trees were cut and burned with abandon to clear the land; before long many of the best forests of a new land were destroyed. Only slowly, with the rising tide of a conservation movement, did trees regain their ancient esteem.

The great conservation debates of the last century helped prepare public opinion for the founding of Arbor Day by Julius Sterling Morton in 1872. Gradually Morton's idea of a special day devoted to the planting of trees spread throughout the Nation and abroad. Today all 50 States observe Arbor Day, most frequently during April.

It is not sufficient, unfortunately, to simply plant a tree. The tree must survive. For the hard truth is that as urbanization increases, so does the list of hazards to tree life. Along with those traditional foes, insects and diseases, there are such modern ones as smog-laden air, road salt, reflected heat, droughty and compacted soil, to cite a few. ARS scientists are engaged in finding and developing more enduring trees for urban America. Their research efforts include selecting vigorous and resistant stock for propagation, breeding hybrid trees, preventing and curing diseases, and devising techniques that enable trees to withstand polluted air.

Science will provide better trees for tomorrow's Arbor Days and also join in disseminating the vast amount of public information needed if well-intentioned plantings are to survive. But looking ahead, we should celebrate Arbor Day not only on its official date, but every day. Trees are vital to our lives and also complement them, extending both material and spiritual wealth. Every schoolchild is taught about two benefits of trees: their role in maintaining global environmental stability and their provision of the only renewable resource used in construction. True, trees make weather, they make wood. Those who spend time in their company learn another and more personal lesson. Trees also make peace.

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COVER: Scientists are unlocking the secrets of the basic life processes of plants with the aid of the REP machine. Here, Dr. Clough checks the accuracy of automatic switches which control the timing and movement of the machine and its doors (0973X1470–2).

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Reeled gas hose and electrical cable are visible as the REP machine tracks to its next recording position in a soybean test plot (0973X1466–28).

THE REP MACHINE

GAINING a better understanding of the basic life processes of plants may lead to improved screening of crops for productivity and to more refined crop management systems.

To monitor these life processes, ARS soil scientist Doyle B. Peters has designed a mobile apparatus in cooperation with the Illinois Agricultural Experiment Station, Urbana, for use in the field—the natural environment of plant communities. Dr. Peters calls the apparatus the REP machine, and with it he measures the rate of function for the three basic biological mechanisms of plants: respiration, evapotranspiration, and photosynthesis.

An important area of Dr. Peter's research concerns photosynthesis, the process wherein leaves, powered by sunlight, turn carbon dioxide and water into the sugar that ultimately nourishes all life. During the day, plants capture energy from the sun and absorb more carbon dioxide (CO_2) from the air than they give off. The rate of net gain of CO_2 is called the photosynthetic rate; the rate at which CO_2 is given off by night is called the respiration rate.

Dr. Peters makes such measurements with the REP machine, a mobile chamber whose metallic frame is enclosed by transparent plastic. From inside this chamber, which is positioned over crops, a sample of air is pumped through tubing to a stationary trailer where instruments measure and record the rate at which CO_2 is given off or

Doors closed over soybean plots, REP machines capture air samples that are then pumped via hoses to the trailer in background where sensitive instruments measure and record the concentration of CO_2 present. Also recorded is the intensity of sunlight and time elapsed over each plot. Dr. Barry Clough (left), a University of Illinois cooperator, and Dr. Peters check operations (0973X1468–22).

absorbed by the plants under normal variations of sunlight. At the same time, other instruments measure and record the sunlight's intensity.

CO_2 measurements are made quickly to keep experimental conditions inside the REP machine as close as possible to those of the normal environment. When the measurements have been made, an electric motor, controlled by a cam timer, reels up the plastic "doors" just high enough to clear the plants, and the REP machine moves along a track to the next plot.

For measuring rates of change in relative humidity, or evaporation rates, Dr. Peters installed a wet and dry bulb psychrometer in the REP machine.

Before the REP machine was invented, scientists used other techniques for studying the basic life processes of plants in the field. These methods required much more instrumentation and larger plots. Furthermore, only one plot could be studied at a time. With the new mobile system, many plots covering less than 3½ square yards can be monitored independently of neighboring plots. The system is especially useful for comparing the life processes and responses to experimental management practices of different crop varieties and breeding lines under field conditions.

Dr. Peters and his colleagues have an immediate interest in finding clues about limitations on soybean yields. Generally, yields of soybeans have not improved as rapidly in recent years as have those of other crops. Dr. Peters will work closely with plant breeders of the U.S. Regional Soybean Laboratory, Urbana, comparing the efficiency of basic life processes of different genetic lines of soybeans. Later, he plans to conduct such studies with wheat, alfalfa, and corn.

Besides comparing different genetic strains, Dr. Peters will study the relationships of basic factors that influence photosynthesis, such as light, water, and fertilizer.

Photosynthetic efficiency and growth, or dry matter yield, are understood as being closely related, Dr. Peters said, but comprehending a host of determinants of grain yield seems more difficult. While developing the REP machine, he noted that respiration rates of different varieties varied more than did photosynthetic or evaporation rates. He plans to find out how respiration rates may affect grain yields.

In earlier studies, nighttime respiration—the expenditure of CO_2 and energy gained during the day—was high in corn and wheat when temperatures were high while yields were correspondingly low. Soybeans, however, were relatively insensitive to nighttime temperatures.

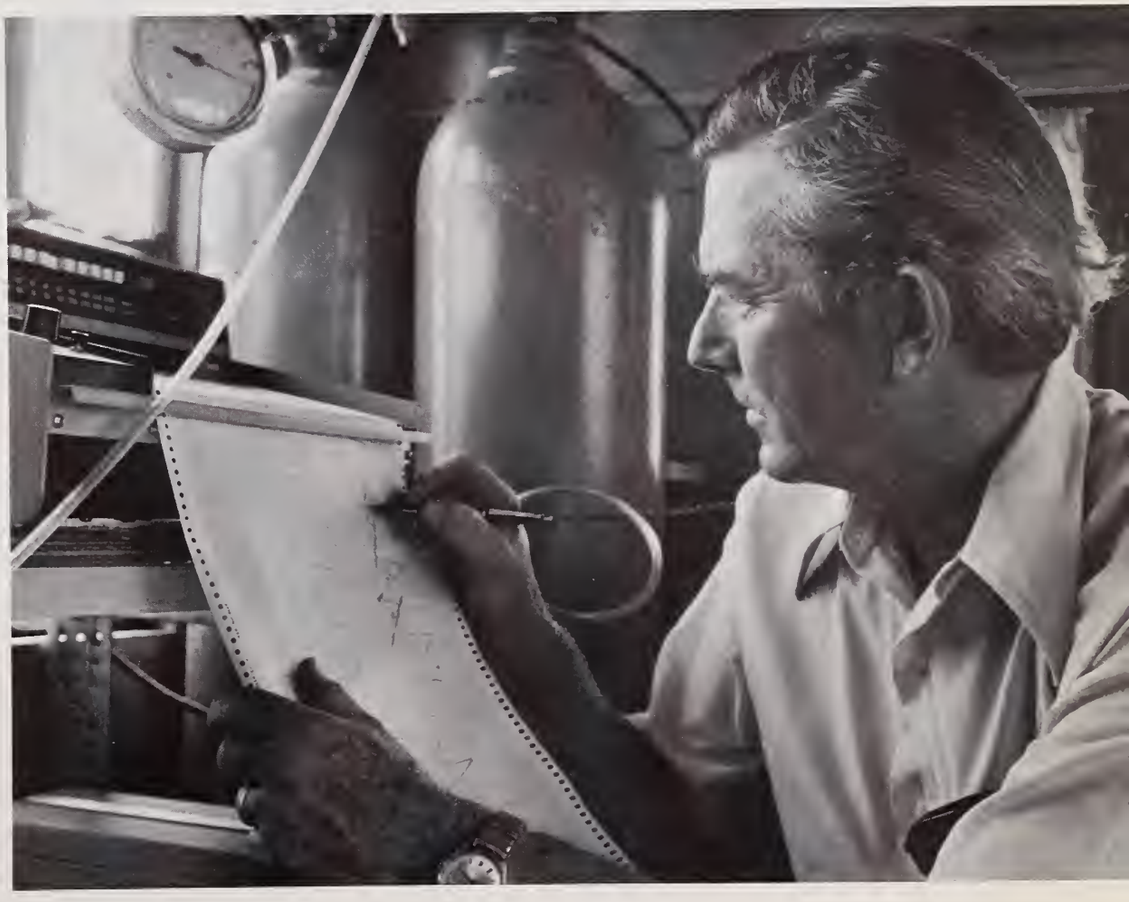
The REP machine enables scientists to study yields while making frequent observations of the basic mechanisms in relation to each other throughout the

Left: *Dr. Peters observes reeled "doors" come down as REP machine is readied to record the vital life processes of soybeans on still another test plot (0973X1468–12).* ***Below:*** *In instrumentation trailer, Dr. Peters studies recordings of CO_2 concentrations and sunlight intensity from soybean plot studies with REP machine (0973X1467–5).*

crop's vegetative, reproductive, and maturation periods. Scientists also have available a complete history of the microclimate, rather than relying on records of average temperature and average radiation.

Dr. Peters pointed out that short-term events may influence yields significantly. For example, while soybeans are in bloom, only a few days of hot weather will cause their flower pods to close up, wither, and die.

Studies on the effects of various stresses—insects, diseases, weeds—on yields and the basic life processes could benefit from the REP machine. By gaining a thorough understanding of the status of crops through timely data—not at the end of a season—scientists could make immediate evaluations of management practices. The provision of such timely data could give the REP machine a central role should crop grower's advisory services become a reality. □



Enhancing a Good Thing

SANDWICHES no longer have a corner on that high protein concoction—peanut butter. It has traveled to outer space with the astronauts on the Mercury and Apollo missions and under the ocean in the U.S. Navy Sealab experiments. Gourmets recommend it in soups, sauces, and baked goods. Gourmands spread it on bananas. Kids lace it with chocolate, spoon it on jelly, and top it with marshmallows. Its credentials to nutrition-conscious consumers: 26 percent protein, high concentrations of B vitamins, phosphorus, thiamine, and niacin.

ARS chemists at the Southern Regional Research Center (SRRC) in New Orleans consider continuing research on peanut butter a "must." "For example," said research chemist Robert L. Ory, "USDA purchased more than 23 million pounds of peanut butter for distribution in the school lunch program in 1972. In the past five years consumption of peanut butter has been increasing three times as fast as the population growth."

What new facts, then, are scientists finding about the nutritional value of peanut butter and its shelf life?

Analytical techniques employed by ARS scientists at both the Southern and Western Regional Research Centers have previously shown that roasting peanuts for one hour at 155° C., a temperature high enough to lower the protein quality of animal proteins, does not damage the major protein of the peanut. Scientists also compared the nutritional quality of peanut proteins heated at five temperatures (110, 120, 130, 145, and 155° C.) to that of casein as a standard protein. Feeding tests with rats showed that the Protein Efficiency Ratio (PER) for meals prepared from peanuts dry roasted at 120° C. was 1.94, compared to 2.5 for casein. PER is one of the measurements of the nutritional quality of protein in a diet. These temperatures were lower than those used in commercial roasting

processes, but the 1-hour heating period was much longer than that employed by the industry. Researchers concluded that roasting temperatures used to enhance aroma and flavor probably do not damage all of the proteins in peanut butter or roasted peanut products. Peanut butter is still a good supplementary protein.

"Shelf life of peanut butter must be extended because as sales increase, the containers for home use and school lunch programs are getting larger," said research chemist Allen J. St. Angelo of the SRRC. The problem lies with oxidation. When peanuts are homogenized, the release of oil normally stored in distinct subcellular particles within the kernels makes the oil more susceptible to turning stale. Peanut oil contains 80 percent of unsaturated fatty acids which, when oxidized, form peroxides or hydroperoxides, causing poor flavor.

Attempts to extend the shelf life of peanut butter by researchers at SRRC include evaluation of many minor constituents as possible catalysts of the oxidation of unsaturated fatty acids. One, an enzyme called lipoxygenase, was isolated from raw peanuts and its properties determined, and then was put back into peanut butter for long-range experiments. Results showed that the roasting process destroys all enzyme activity in peanut products, but is responsible for production of nonenzymic catalysts.

After some of the major nonenzymic causes of rancid flavors or odors were identified, studies were begun to find possible ways of blocking the catalytic effect. This research is still underway.

Importance of the on-going research is indicated by a growing demand for the product. How much peanut butter are U.S. consumers likely to eat? About 450 million pounds of peanuts go into peanut butter every year. The amount may grow to 550 million pounds by 1980. □

When Germination Matters

THE germination quality of cottonseed can be seriously impaired by even relatively short delays between the harvesting and ginning of wet-picked cotton.

Anselm C. Griffin, ARS research physicist, at Stoneville, Miss., reports that wet-picked cotton loses its germination potential at the rate of more than 10 percentage points a day for the first 3 days of storage, while the dry-picked cotton maintains its original high germination percentage unchanged through a 7-day storage period.

The water content of cottonseed appears to be the most important single factor that determines whether normally harvested seed cotton may be stored without fiber damage and cottonseed deterioration.

In the research, cotton picked wet with dew was delivered to the laboratory with an initial cottonseed water content averaging 20 percent, while the field-dried cotton was delivered to the laboratory with a water content of about 13 percent. At the end of a 7-day storage period, the cottonseed moisture content of both the picked-wet and field-dried cottons varied only slightly from their initial moisture contents.

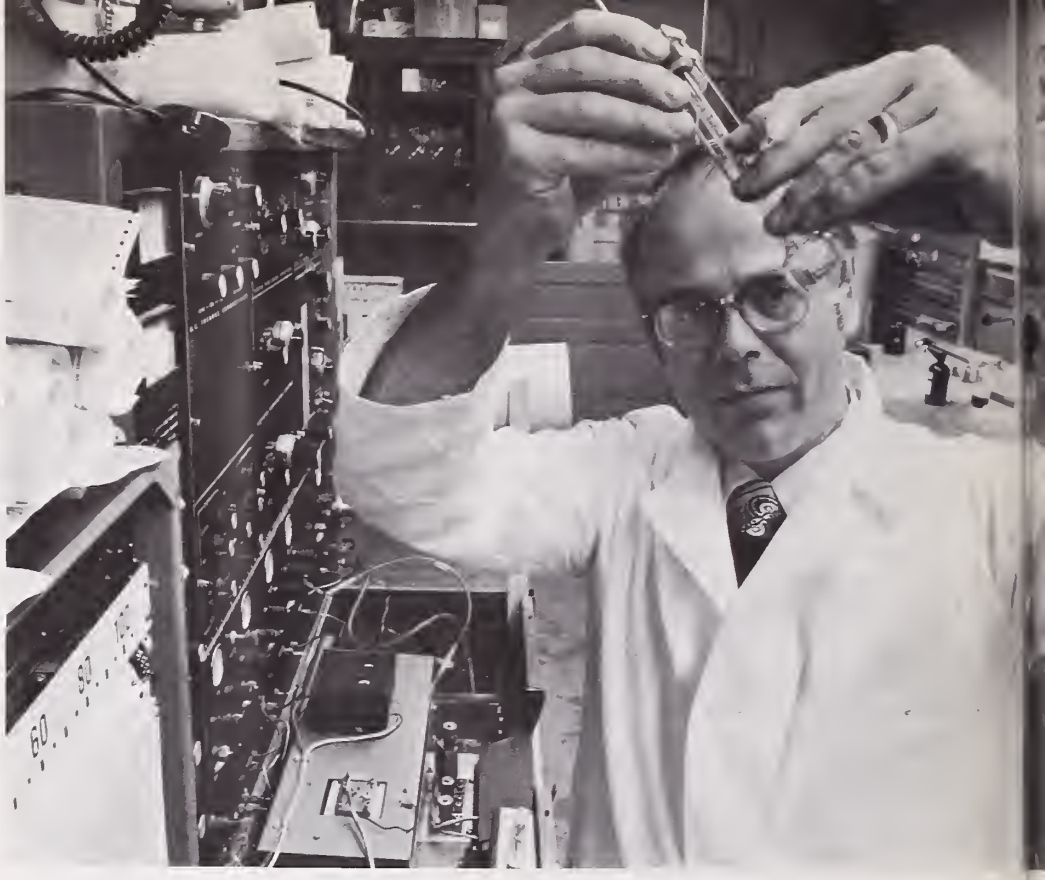
Two 3-bale trailers were used to store the test cotton under cover for 7 days. One trailer was filled with cotton picked wet early in the morning; the other trailer was filled with cotton picked dry during mid-afternoon of the same day. Six thermocouples in each trailer monitored load temperatures during the 7-day storage period.

The temperature of the picked-wet cotton rose constantly throughout the 7-day storage period from 87° to 129° F. The most rapid rise occurred within the first 3 days of storage, from 87° to 123° F. Microbial activity of bacteria primarily brought about the rise in temperature; respiration of the seeds played a lesser role.

The temperature of the field-dried cotton averaged 100° F. at the beginning of the storage period. It rose slightly after a day of storage, then began to drop continually, averaging 87° F. and approaching ambient air temperature at the end of the 7-day storage period.

The two harvesting treatments produced different results in cottonseed germination. Cottonseed from the field-dried cotton maintained its germination ability at the pre-storage level—about 88 percent germination throughout the 7-day period. Cottonseed from the picked-wet cotton, however, suffered loss in germination. Germination percentage declined rapidly. After only 4 days, it had dropped to below 30 percent. Germination losses for individual replications after only 24 hours of storage ranged from 9 to 22 percentage points.

Growers should gin wet-picked cotton without delay in order to avoid substantial germination losses to the cottonseed. □



Various isomers—or geometrical arrangements—of synthetic sex attractants are being evaluated by ARS and Iowa State researchers at Ankeny. Here, Dr. Klun prepares one such sample for analysis by gas liquid chromatography. Once the geometric composition of the sample is determined it will be field tested for potency (0174X42–17).

Jamming Insect Communication Systems

DISCOVERY of a way to disrupt male-female communication links may lead to a new biological control method against two insect pests.

In the past, sex attractants have been identified and produced synthetically for several species. Researchers say these synthetic attractants could be employed in two basic ways—to trap the insects, mainly for survey purposes in integrated control programs, or to disrupt normal sexual behavior of the insects. Both methods of employing synthetic attractants have been studied extensively by entomologists and chemists throughout the world.

Now, a team of ARS and Iowa Agriculture and Home Economics Experiment Station scientists at Ankeny, led by ARS entomologist Jerome A. Klun, has scored a breakthrough in understanding the sexual-chemical systems of the European corn borer and redbanded leaf roller moth. Females of both species emit a chemical, 11-tetradecenyl acetate, to attract their mates (AGR. RES., Feb. 1970, p. 7). This compound exists in two geometric forms, or isomers, designated Z (cis) and E (trans). The Ankeny research team has found that a mixture of the two isomers attracts the insects much more effectively than do pure isomers.

Researchers found that males of the Iowa strain of European corn borers respond best to a mixture of isomers containing 96 parts Z and 4 parts E (96:4 Z/E ratio). On the other hand, male redbanded leaf rollers are most attracted to a 92 : 8 ratio.

Dr. Klun said the research indicates that although females of both species use the same chemical to attract their mates, the difference in the Z/E ratios naturally minimizes the possibility of a male pursing a female of the wrong species even though the mating flights of the two species occur concurrently.

Below: *Lured to their deaths against the sticky surface of an attractant-loaded trap, these European cornborer moths bear mute testimony to the effectiveness of synthesized 11-tetradecenyl. Entomologist Jerome A. Klun is shown inspecting the trap (0174X39–1).* ***Bottom:*** *It works! In a field test with the new synthetic sex attractant, researchers count European cornborers and redbanded leaf roller moths lured to traps the previous evening. Shown in an Iowa cornfield during last summer's experiments are (from left) Iowa State University graduate students Michael W. Barry and Kenneth C. Mattes with Dr. Klun (PN–2852).*

In field tests, the researchers disrupted the male-female communication link by distributing synthetically produced E isomer. Males were not attracted to the scent of their potential mates because the proportions of the Z and E isomers in the treated area were altered.

Observing the success of the experiments, Dr. Klun said, "The use of this disruptive technique to reduce mating by insects may be an easier method to implement than has been thought." Further knowledge is needed, however, to find the best means of dispensing the isomer and minimizing any possible detrimental environmental effects.

In the past, the significance of minor amounts of the E isomer mixed with the Z isomer was not realized. Dr. Klun said, because of the nature of bioassays and chemical methods routinely used in investigations of insect sex attractants. Moreover, in laboratory synthesis of the Z isomer. a pure product is not obtained.

Dr. Klun pointed out that other species of moths may also possess the olefactory apparatus that permits detection of small variations in the geometric composition of sex attractants. In only a few studies of sex attractants of insects in the Lepidoptera order, Dr. Klun said, have the exact geometric compositions of the synthetic attractants been reported.

In view of the recent findings, he suggested that previous research should be re-evaluated and future studies should routinely include an investigation of insect response to varying geometrical proportions of attractants. This could advance knowledge of the chemical communication systems of insects and perhaps bring the day closer when their sex attractants will be useful in suppressing insect pests. □

Farmer walks across a saline seep, an area rendered useless for agriculture by pools of salty water that have seeped up from beneath the earth's surface (PN–2854).

Staving Off Saline Seeps

GREAT NATIONS may spring from the "salt of the earth," but crops won't. Pools of salty water seeping up from beneath the earth's surface to render land useless to plant and animal life pose big problems for the environment unless present farming practices are modified.

An ARS study recommends rotating small grains, grasses, and deep-rooted crops in an intensive cropping system—while keeping summer fallow to a minimum—to control the development of saline seeps, a problem that increasingly besets farmers in the Great Plains of the United States and Canada.

Saline seeps are formerly productive, nonirrigated soil areas that become too wet and salty for crop production. In Montana alone, there are over 80,000 acres of saline-seep areas, increasing in size each year by almost 10 percent. Nearly $5 million in Montana farm income is lost annually—not including the value of the land itself.

Saline seeps also salinize ground water, making it undrinkable for humans or livestock. Seeps frequently dissect fields, creating a patchwork of soggy areas that make seeding and harvesting difficult and costly.

Saline seeps may develop near hilltops, on sidehills, at the base of hills, and on lowlands. Usually seeps occur where there is a sudden change in the slope of the land, but not necessarily at the low point in the topography. From surface information and topography it is difficult to predict where saline seeps may develop, so an ARS research team examined the subsurface characteristics of seep areas.

ARS soil scientists Ardell D. Halvorson and Alfred L. Black, Northern Plains Soil and Water Research Center, Sidney, Montana, drilled a series of test holes in a radial pattern emanating from a selected seep area, to learn specific causes of saline seeps, and to explore the relationship between saline seeps and precipitation, soil water content, and plant usage.

When precipitation exceeds crop needs, water percolates or trickles below the crops' roots, and accumulates above a dense, nearly impermeable layer of clay. Unable to penetrate farther, the water starts moving laterally through permeable layers of degraded sandstone, siltstone, and lignite.

The lateral movement ends when the water-conducting soil layers meet glacial material, called till, or other materials with less permeability, causing the water table to rise. Capillary force moves the water upward from the

water table, through the till, to the soil's surface, much as a towel absorbs water. Once on the surface, the water eventually evaporates, leaving precipitated salts, collected along the water's journey, in the wake. Salts generally include sodium, magnesium, and calcium sulfate.

A typical salt concentration in seepwater found by the ARS study was 13,000 parts per million. Assuming that 1 inch of rainfall over a 10-acre area percolates to the impermeable clay shelf; and assuming that all of this water is channeled into a seep area of 1 acre; then using the ARS researchers' typical figure, 14.7 tons of salt would remain in the seep area after the water evaporated. For a plant to sustain itself on this soil would be like a person trying to quench his thirst in the ocean.

Present crop-fallow farming practices in the Northern Great Plains are a principal cause of today's saline seep problems, particularly in years of above average precipitation. Timely fallow operations, good weed control, stubble-mulch fallow, and wind barriers enhance saline seep development because these practices allow more precipitation to be collected than the crops will use, hence more water moves down below the crops' root system.

Research and farmer experience indicate that if susceptible areas are cropped more frequently and less land is allowed to go idle during the summer, development of new saline seeps and increases in size of old ones will be significantly reduced. The more use made of rainfall, the less remains for developing saline seeps.

Perennial grasses and legumes grown on a permanent or semi-permanent basis in long-term crop rotation will help reduce the problem. Their active growth throughout most of the season permits little precipitation to percolate beneath the root zones.

At this time, recropping to small grains involves some risk. The possibility of inadequate water and nutrients in the root zone, and potential increases in weed and plant diseases, exists.

To reduce this risk ARS and the Montana Agricultural Experiment Station, Bozeman, have signed a 2-year, $60,000 cooperative agreement to develop soil management systems and new farming practices that will minimize the saline seep problem, yet still be attractive to farmers. □

Above: *Aerial photo depicts a saline seep that occurred in a crop fallow system. Moist soil shows in center, ringed by salt-crusted soil (PN–2855).* ***Left:*** *Another saline-seep area. It grew a normal crop of corn in 1970; now the land is sterile (PN–2856).*

The compact steam blancher in operation. Mr. Brown begins process by feeding carrots into the blancher as Mr. Bomben adjusts controls (left) and Mr. Dietrick records temperature of product sample (0174X105–28A).

A Better Blancher

An experimental steam blancher may someday help food processors to reduce the costs of buying water and disposing of wastes. Looking to the future, processors may achieve even greater savings as more utility districts begin charging industries according to the volume and strength of the effluent they discharge.

Processors primarily steam-blanch food to partially cook it, thus inactivating enzymes that would cause off flavor in the frozen product.

Tests show that the new steam blancher, under development at the ARS Western Regional Research Center, Berkeley, Calif., can blanch peas at a cost of about 7 cents per ton. This figure, based on the projected 1975 rate schedule for a water district in the San Francisco Bay area, includes purchasing water and providing secondary treatment after its use. By contrast, these costs for a conventional steam blancher would run from $0.35 to $0.60 per ton of peas or carrots; with a water blancher, $0.85 to $1.40.

The new steam blancher uses steam more efficiently than do commercial units. Conventional blanchers are at best 60 percent efficient, while the new steam blancher is between 80 and 95 percent efficient. Efficiency is measured by the percentage of steam delivered to the blancher that is actually used to heat the product.

With steam currently costing about $1 per 1,000 pounds, costs for heating the ARS blancher are only $0.30 per ton of blanched peas. With conventional steam blanchers, these costs run between $0.50 to $1.50; for conventional water blanchers, $0.80 to $1.20.

In operation, the continuous pilot plant model funnels the food product into a circular top conveyor tray. While inside the funnel the vegetables pile up, forming a vertically downward moving plug, a "seal" against escaping steam.

Vibrating at 3,600 strokes per minute, the top conveyor tray moves up to 300 pounds of peas per hour through a steady bath of steam until the product falls through a slot, landing on a second vibrating tray. This process allows time for the product to pick up enough heat to raise the average mass temperature

to that required for blanching. This is known as the IQB or individual quick blanching principle (AGR. RES., July 1971, p. 14).

The lower tray vibrates the product along its route until it drops into a flexible pipe, again forming a plug to trap steam. While held in the pipe, the product is completely penetrated by heat and thus completes blanching.

After blanching, the vegetables are spread out in a single layer and conveyed into the cooler. An atomizer sprays recycled liquid from the blancher into a cooling air stream produced by two fans. The vegetables absorb some of this blanching liquid, thereby reducing losses of product weight and nutrients due to evaporation and leaching.

Blanching in a regular steam or water unit requires from 1½ to 2½ minutes. Total time for heating and holding in the ARS unit is the same as heating time for conventional blanchers. Tests show that no additional energy or fuel is required for the holding step. Cooling times for the new unit are about the same as for conventional spray-mist systems.

Another important advantage of the new blancher is that its modular design takes up much less floor space than do conventional units. The ARS blanching unit is compact, with product flow from top to bottom rather than on a horizontal plane.

The ARS research team—engineers George E. Brown, John L. Bomben, Daniel F. Farkas, chemist William C. Dietrich, and technician Joyce Hudson—is now refining a new cooling system which eliminates the horizontal cooling bed.

The new design places the vegetable product on the bottom of a solid-covered spiral vibrating conveyor which moves the pieces upward. Again, an atomizer recycles blancher liquid into the cooling air stream. As the pieces work their way upward and out the top, they lose heat. The new cooling system reduces still further the required amount of floor space. □

Top right: *Mr. Brown inspects the distribution pattern of diced vegetables on circular tray. Steam coil is exposed in the tilted blancher cover (0174X106–25).* ***Middle right:*** *After vibrating down from the circular tray, the vegetable product falls into this flexible tube where it forms a steam-sealing "plug," thus allowing heat to thoroughly penetrate the product—completing the blanching process. A technician uses an indicator rod to check the amount of vegetable product within—information necessary for determining the proper length of heating time (0147X107–19).* ***Bottom right:*** *Researcher takes a sample of processed vegetables to check the efficiency of the cooling system (0147X105–29A).* ***Bottom left;*** *Cover of cooler has been lifted to reveal its spiral conveyor, a design that saves space. Mr. Bomben checks quality of vegetables (0174X107–35A).*

Barbara Ward Named Morrison Lecturer

BARBARA WARD, British economist, author, and president of the International Institute for Environmental Affairs, London, will present the seventh annual B. Y. Morrison Memorial Lecture.

The lecture will be delivered on May 12 in Chicago, Ill., before the annual meeting of the American Society of Planning Officials (ASPO).

ARS established the Morrison Lecture in honor of Benjamin Y. Morrison (1891–1966), the first director of USDA's National Arboretum in Washington, D.C. The theme of the 1974 ASPO Conference will be "The Politics of the New Scarcity."

As a writer, scholar, and educator, Miss Ward is noted for her penetrating analyses of international relations and the complex socio-economic implications of a world divided among developed and developing nations. She held the Albert Schweitzer Chair of International Economic Development at Columbia University, N.Y., from 1968 to 1973.

A consultant to the Secretary-General of the United Nations Conference on the Human Environment in Stockholm in 1972, Miss Ward served in a leadership and advisory capacity with nongovernmental organizations during the conference. She was also the co-author with Rene Dubos (fifth Morrison lecturer) of *Only One Earth* (1972), a book that set the conceptual framework for that conference.

Her other published works include *The West at Bay* (1948), *A Policy for the West* (1951), *Faith and Freedom* (1954), *Five Ideas that Change the World* (1959), *Nationalism and Ideology* and *Spaceship Earth* (both 1966).

Miss Ward was educated at the Sorbonne and at Oxford and is a contributing editor for the *Economist* of London. She is an honorary member of the American Academy of Arts and Sciences and holds honorary doctoral degrees from many American universities and colleges.

Miss Ward was a Carnegie Fellow from 1958 to 1966 and a Visiting Scholar at Harvard University from 1958 to 1968.

Morrison lecturers are nominated by representatives of national and international organizations concerned about the environment. □

a crystal-controlled stopwatch

TIME may be as "boundless as the sea," nonetheless, man needs to measure it. A recently developed crystal-controlled stopwatch meets research needs for a compact, accurate timer for laboratory and field work.

Designed by ARS electronics engineer Herbert D. Fisher, Kimberly, Idaho, and physics professor Mary Ann Fisher, College of Southern Idaho, Twin Falls, the new crystal time-based stopwatch, which is powered by mercury batteries, fills the present gap between mechanical balance wheel stopwatches and electronic counter timers.

Electronic counter timers are sophisticated but expensive. Balance wheel stopwatches are relatively inexpensive but are often incapable of measuring time in sufficiently minute increments. The crystal timepiece is 1,500 times more accurate than the balance wheel stopwatch. Parts for the crystal watch cost about $85.00; for an additional $10.00 two photo-detectors and pulse amplifiers give the watch far more versatility.

Other crystal-controlled stopwatch features include direct digital readouts (including decimal points) of an experiment's accumulated time; three separate switches to control start, stop and reset; and illuminated numerals that are visible in high and low room light. By adding photo-detectors and pulse amplifier circuits, the stopwatch can be used as a completely automatic interval timer.

Although originally designed for agricultural research scientists, the crystal stopwatch can be used in a general physics laboratory. When used automatically, the crystal stopwatch should reduce most timing errors to statistical "insignificance." □

AGRISEARCH NOTES

New soy concentrate

NINETY-FOUR PERCENT of the protein and 85 percent of the oil in soybeans is retained in a new soy concentrate developed for use in beverages and formulated foods.

Soy beverages are used in many parts of the world to prevent protein deficiency in the diets of babies and children. Milk production in developing countries is often inadequate to meet nutritional needs, and supplies of nonfat dry milk for world distribution are declining. In the United States, soy milk is used for feeding babies who are allergic to cow's milk.

The new soy concentrate produced by the ARS process reconstitutes in water to a smooth, light-colored, bland base. A wide variety of high-quality beverages or formulated foods can be produced by adding minerals, vitamins, and flavor ingredients. Beverages prepared by adding either a Dutch chocolate-flavored prepared mix or sugar, salt, and synthetic milk flavoring to the bland base were quite acceptable in taste-panel tests.

The procedure was developed by ARS chemical engineer Gus G. Mustakas, Northern Regional Research Laboratory, Peoria, Ill., who first isolated the concentrate from full-fat soy flour. An entirely new procedure, involving a two-step cooking process, then removes or inactivates enzymes that would limit shelf life, undesirable growth inhibitors, and carbohydrates but retains a higher percentage of the protein than previously developed processes. Wet milling and homogenizing reduce the concentrate to a fine particle size and produce a product with excellent suspension properties in water.

Cemetery vases breed mosquitoes

FLOWER VASES and urns placed in cemeteries are often ignored as mosquito breeding areas. Yet these containers can be an urban area's prime source of mosquitoes.

When wilted flowers are not discarded and their vases removed or turned upside down, the vases often become mosquito-producing habitats that require periodic insecticide treatments.

Vases holding artificial flowers may pose even more of a problem. Artificial flowers are more permanent than real ones and the vases holding them remain out longer, accumulating moisture from rainfall and sprinklers.

An ARS scientist has devised a control method, one that completely eliminates the need for insecticides, for use on vase-bred mosquitoes.

Leyburn F. Lewis, assisted by Darrell M. Christenson, both of the ARS Western Insects Affecting Man and Animals Laboratory, Fresno, Calif., found that mosquitoes will not lay eggs on water that has a small surface area.

Mr. Lewis constructed grids with ½- by ½-inch spacings and placed them inside steel cemetery vases. The mosquitoes, *Culex pipiens quinquefasciatus* Say, did not lay any egg masses in urns with the ½-inch grids. Breaking up the total surface area of the water into smaller segments completely eliminated a breeding place for mosquitoes.

Vases with grids of ¾- by ¾-inch spacings showed over a 95 percent reduction in egg masses while spacings of 1-inch proved totally ineffective.

Mr. Lewis points out another benefit: flower arrangements will be easier for owners of vases equipped with the grids.

Safety masks for cane fields

FEW CONSUMERS of sugar realize what is involved in removing 12-foot-tall sugarcane samples from the fields. But experienced laborers, breeders, and selectors well know the vicious cutting and tearing action of the sawlike edges of sugarcane leaves. Inexperienced laborers learn at once to cover their arms, legs, and hands completely when walking through standing or partially lodged sugarcane.

A major problem, according to agricultural research technician Floyd J. Robichaux, is adequately protecting the vulnerable eyes, nose, and ears of workers without obstructing their vision. Face protectors tried at the ARS Sugarcane Field Station in Houma, La., ranged from plastic shields worn by welders to various masks of wire mesh like those worn by beekeepers. Cane leaves scratched the plastic shields making it impossible to see through them. The wire masks not only obstructed vision, but were heavy.

Researchers at the Houma station, working with the Louisiana Agricultural Experiment Station, have came up with a saran green shade fabric which does not affect vision, is cool, comfortable, and sheds water. Vision was so little affected, the wearer could even read a hand refractometer, a device necessary for determining the total solids in a juice sample in the field.

Generally used to shade greenhouses, the plastic material was shaped into hoods or masks, or draped from under hats and caps to cover both face and neck.

Not only did the material—woven to provide 30 percent shade—prove successful in permitting good vision, but research technicians believe it should reduce significantly the number of eye injuries in future selection seasons.

Nitrogen from rainfall

NITROGEN received in rainfall can account for two-thirds of the soluble nitrogen in surface runoff from normally fertilized cropland.

ARS soil scientists Gerald E. Schuman, Lincoln, Nebr., and Robert E. Burwell, Council Bluffs, Iowa, found that rainfall contributed an average of 6.47 pounds of nitrogen per acre each year in an area where annual precipitation is about 30 inches. Precipitation nitrogen was equivalent to approximately two-thirds of the soluble nitrogen in runoff from a watershed planted to corn and fertilized at the recommended rate of 150 pounds of nitrogen per acre. On an adjacent watershed fertilized at 2½ times the recommended rate, rainfall supplied 53 percent of the soluble nitrogen measured in runoff.

"Obviously, it is impossible to control nitrogen in the rainfall, and this source can make a significant contribution to nitrogen levels in lakes and ponds," Mr. Schuman noted. He emphasized, however, that runoff carrying nitrogen from the land can be reduced by effective conservation practices.

The Nebraska and Iowa Agricultural Experiment Stations cooperated in the 2-year study near Treynor, Iowa.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

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